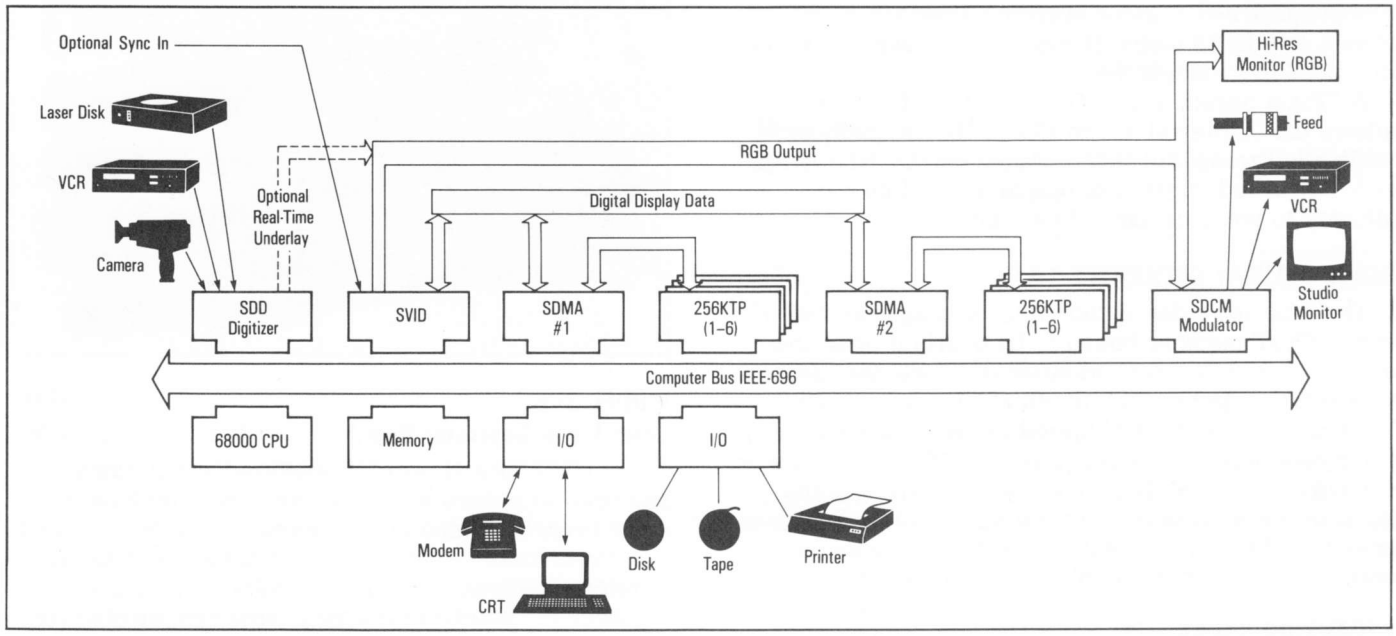
S-SERIES
68000 Graphics



FEATURES

- TV broadcast quality computer graphics system
- 1024 × 1024-point "canvas" with
  756 × 484 display window for NTSC
  756 × 577 display window for PAL
- Up to 16 million colors available for natural color rendition
- Instant pan and zoom
- Two-port display memory works with fast 68000 processor
- SDCM encodes output for use with VCR or studio feed
- SDD captures pictures from camera or tape input

THE S-SERIES VIDEO SYSTEM

The components in the S-Series video system are building blocks which form an extremely high performance, easy-to-customize color display system. This system creates sharp images in lifelike color, using more than 1,000,000 picture elements (pixels) and up to 16,000,000 colors per image plane. Since these pictures are stored digitally they may be regenerated, edited, enhanced, or duplicated under control of one of Cromemco's high-speed supermicrocomputers. The S-Series video cards plug right into the computer bus, making it easy to add options such as a digitizer or more image planes. The combination of video quality and computer power is unmatched in the industry and finds applications ranging from digital paint systems in an art studio to solid modeling systems in an engineering lab.

SYSTEM ARCHITECTURE

There are five main boards in the S-Series video system. The first three form the display generator board set, comprising image memory (256KTP), video memory controller (SDMA), and color video interface (SVID). These boards provide a basic display capability when plugged into a 68000-based Cromemco computer. An input interface, the SDD, allows signals from a camera or video tape recorder to be digitized and stored for processing or display. An output interface, the SDCM, converts the video output from RGB + Sync into an NTSC composite signal which may then be fed to a video recorder, monitor, or studio feed. Activities of all these boards are coordinated and controlled by the host computer.

SYSTEM RESOLUTION (Spatial)

The S-Series video system is based around a 1024 × 1024 pixel workspace with a moveable 756 × 484 pixel viewing area (756 × 577 in PAL model). The viewing area corresponds exactly to the format used in broadcast television (with additional resolution as required for Nyquist-rate sampling). The quality of the S-Series video images matches the finest broadcast standards.

COLOR RESOLUTION

An often-overlooked but crucial factor which determines image quality is the color resolution. This number represents the number of different colors which may be present in a given image. The S-Series video system allows this factor to be varied from 16 levels to 16,777,216 levels. High color resolution is used for lifelike renditions of objects, while lower resolutions suffice for stylized or schematic representations of images. Images of 16 or 256 color levels use selected hues from a palette of 262,144 standard tones maintained in a color map; high resolution of color does not require use of the map.

HARDWARE PAN AND ZOOM

A "Zoom" function is included to magnify the displayed image without disturbing the memory data. The magnification factor may be varied smoothly from 1 to 4 in 65 steps. Horizontal and vertical zoom functions are independent.

A "Pixel Scroll" (also known as Pan) function allows the displayed image to shift horizontally or vertically throughout the workspace area. The image may be shifted in steps of one pixel, and may be allowed to wrap around, if desired.

IMAGE OVERLAY CAPABILITY

The S-Series video system allows images stored in one 256KTP memory board to be overlaid upon the images stored in a second memory board; this process may be repeated up to a depth of four layers. The "Overlay" function is obtained by use of a special color code which is "transparent." When this color is encountered in the display image on a given plane, the hardware automatically switches to the display image on the next plane. This process is repeated until a non-transparent color is encountered.

EXPANSION CAPABILITY

Advanced systems may use additional memory controller (SDMA) boards to handle extra two-port memory boards. This allows independent control of a foreground and background image. A "sprite" effect may be obtained by moving a foreground image across a fixed background; a "stencil" effect may be obtained by switching between foreground and background images according to the pattern of a third image, called the stencil image. Elaborate special effects are possible by manipulating the image and stencil planes separately.

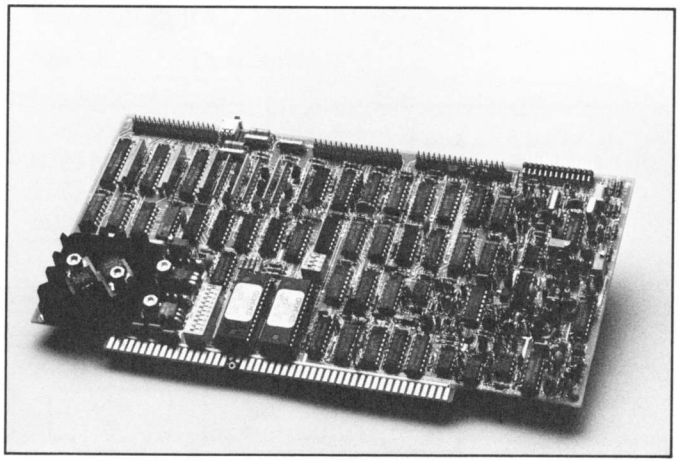
CHOOSE NTSC OR PAL

Two families of boards are available in the S-Series: one complete set for use in NTSC systems, and another set for use in PAL systems. NTSC is the standard used in the United States, while PAL is found in many other parts of the world.

The PAL implementation is complete: a picture of full width and length is generated. This capability extends throughout the line, from the digitizer input through the space modulator output.

USE IN A BROADCAST ENVIRONMENT

The S-Series video system has been designed for ease of use in a broadcast environment. System setup is aided by a built-in color bar generator to check the video output. Inputs are provided for timing and color standard signals (or black burst), and the video output may be calibrated to match exactly signal levels and timing.



MODEL SVID

Color Video Generator Board

The SVID board provides the analog functions required to generate the display. These include the color map, the video digital-to-analog converters, and the phase-locked loops for sync timing and color subcarrier. The sync and color circuits may be ganged together for black-burst synchronization, or operated separately if required. A color bar generator is included on the board. Outputs from the SVID include Red, Green, Blue, and Sync signals suitable for use with a high-quality RGB monitor or the SDCM composite color encoder.

TECHNICAL SPECIFICATIONS Model SVID

Resolution: Maximum displayable pixels out of a field of 1024 × 1024: 756 × 484, NTSC; 756 × 577, PAL.

Color Levels: 16, 256, or 16,777,216 (depends on memory configuration).

Color Map: Selects 16 or 256 colors from palette of 262,144; may be disabled for 16 megacolor mode.

Outputs: Three analog outputs (Red, Green, Blue) and composite sync.

Required Display Memorys and Controller:

One or more 256KTP two-port memory; supports 1 to 6 cards.

One or more SDMA memory controller card.

Scroll range: 0 to 2048 pixels; selectable wrap-around.

Sync Signal: Composite sync signal is switch-selectable. Separate RS-170 sync signal available.

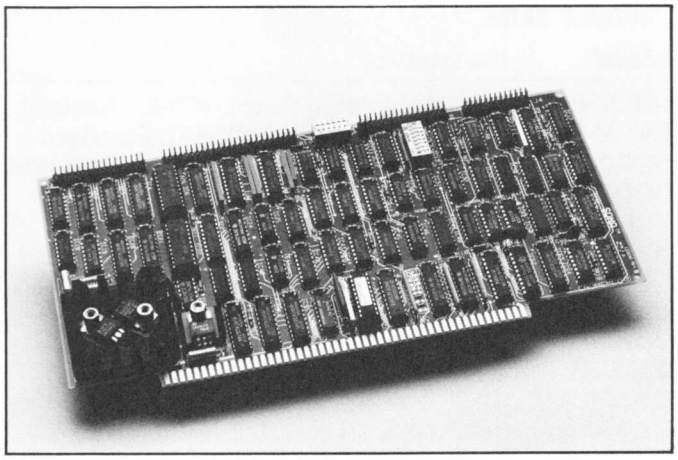
Sync Inputs: Separate Color and Timing inputs; may be ganged together to accept "Black Burst" input.

System Bus: IEEE-696 (S-100)

Power Requirements:

+ 8 volts at 3A (max)
+ 16 volts at 100 mA (max)
– 16 volts at 100 mA (max)

Operating Environment: 0 to 55 degrees Centigrade



MODEL SDMA
Video Memory Controller

The SDMA board provides the memory control required at the interface between the SVID and 256KTP boards. The SDMA includes timing chains for generation of horizontal and vertical sync, as well as circuits which allow the memory image to be scrolled or zoomed. A priority circuit is included so that multiple SDMA's can work together when independent control of foreground and background images is required. As many as six 256KTP memory boards may be attached to a single SDMA.

TECHNICAL SPECIFICATIONS Model SDMA

Scroll Functions:
- Axes: Horizontal and vertical
- Range: 0 to 2048 pixels

Image Topology:
- Blanking Off: Image wraps around when scrolled horizontally or vertically.
- Blanking On: Edge of image ends in blank area when scrolled (no wrap).

Zoom Functions:
- Axes: Horizontal and vertical
- Range: 1× to 4×
- Resolution: 65 steps

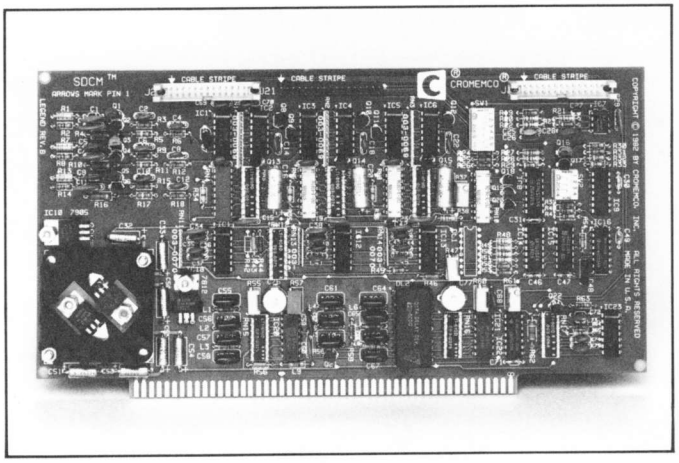
Priority Control:
- Maximum Overlay Depth: 4 image planes

Required Accessory Cards:
- SVID Video Controller (1 per system)
- 256KTP Two-Port Memory (1 to 6 per SDMA card)

System Bus: IEEE-696 (S-100)

Power Requirements: + 8 volts at 2.0A (max)

Operating Environment: 0 to 55 degrees Centigrade



MODEL SDCM
Color Modulator Board

The SCDM is a single board providing professional quality color encoding for the SVID output signals. The SDCM input accepts the signals from the SVID connector and the output provides a composite color signal encoded according to NTSC or PAL standards. This allows a computer-generated image to be displayed on a studio monitor or fed to a VCR or other broadcast equipment.

The SDCM provides an on-board software controlled gamma correction amplifier and separate alias crosstalk filters. Two RS-170A outputs are provided which drive a 75-ohm line with a 1V p-p signal.

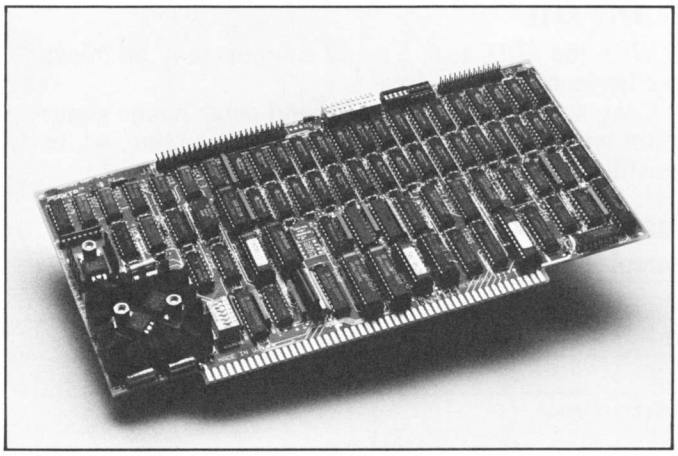
TECHNICAL SPECIFICATIONS SDCM

Output Signal:
- RS-170A composite NTSC color video (SDCM-NTSC)
- RS-170A composite PAL color video (SDCM-PAL)

Bus:
- IEEE-696 (S-100)

Power Requirements:
- + 18 volts at 0.25A
- + 8 volts at 1.0A
- – 18 volts at 0.20A

Operating Environment:
- 0 to 55 degrees Centigrade



MODEL 256KTP
256K 2-Port Memory

The 256KTP two-port memory is used to store image information for the S-Series video system. Each card can store 1024 horizontal pixels on each of 512 vertical lines, with 16 levels (4 bits) of color information for each pixel. Additional cards may be ganged to generate a 1024 × 1024 workspace or to increase the color resolution up to 16 million levels (24 bits). Each 256KTP board includes a priority circuit which works with the SDMA card to allow an image on a high priority board to be overlaid upon the image from a lower priority board. Overlays may be four layers deep.

The 256KTP is designed specifically for Cromemco's 68000-based supermicrocomputers. The processor can load a fresh image or manipulate an existing image through a high-speed memory access port, while the display refresh is taking place on the other port. The 256KTP supports the full address space of the 68000 (16-Megabyte span), and allows data transfers of words or bytes. As many as six boards may be connected to each SDMA controller.

TECHNICAL SPECIFICATIONS Model 256KTP

Memory Capacity:
256K bytes

Maximum Picture Elements (PIXELs) per Line:
1024

Maximum Lines per 256KTP:
512

Color Resolution:
16 levels (4 bits) per pixel per card.
256 levels (8 bits) with 2 cards ganged.
16,777,216 levels (24 bits) with 6 cards ganged.

Main Port Addressing Resolution:
Any 256K boundary in 16-Megabyte address space.

Main Port Access Time:
Fastest (no second port contention): 280 nanoseconds
Worst Case: 560 nanoseconds

Main Port Operating Modes:
Byte Mode: Memory arranged as 256K bytes (word operations also allowed).

Nybble Mode: Memory arranged as 512K nybbles.

Display Port Operating Modes:
Hi/Lo Pixel Data Select: Used in 8-bit per pixel modes.

Display ON/OFF: Turns plane on or off irrespective of overlay.

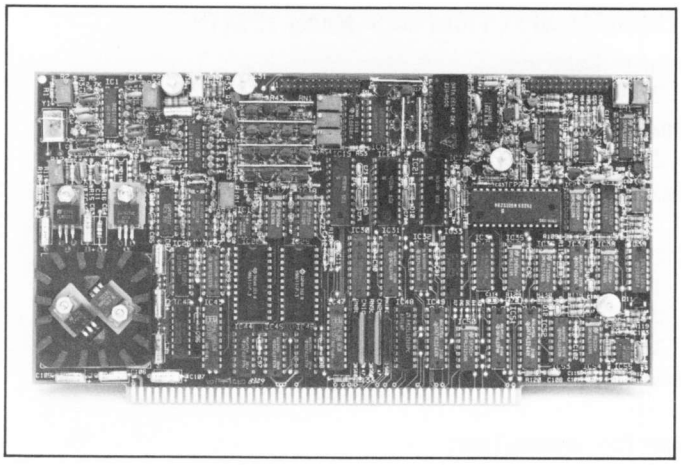
Map ON/OFF: Enables image overlay.

Required Accessory Cards:
SVID Video Controller
SDMA Memory Controller

System Bus:
IEEE-696 (S-100)

Power Requirements:
+ 8 volts at 2.0A (max)

Operating Environment:
0 to 55 degrees Centigrade



MODEL SDD
Color Digitizer Board

Cromemco's new Model SDD Color Digitizer Board provides a low-cost, easy-to-use method for digitizing images in color or black-and-white. With the SDD-NTSC interface and a standard television camera, images with up to 756 × 484-point resolution can be digitized and stored in memory or on disk. Images can then be recalled and processed, or displayed using Cromemco's S-Series video system.

OPERATING MODES

The SDD can digitize in five different modes:

Mode	Sample Use
Unprocessed Composite Video Input	For waveform analysis in debugging a system.
Red Video Component Green Video Component Blue Video Component	For full-color renditions with 24-bit video systems.
Composite Color Conversion with Inverse Color Map Lookup	For mapped-color images in 8-bit video systems.

All of these signals are digitized with 8 bits of resolution per gun, then mapped or sent directly to the computer. Gray scale images can be created from any of these signals by setting the chrominance level to zero under software control.

VIDEO SAMPLING CAPABILITY

A digital phase-locked loop is used for timing all video sampling, dividing the horizontal line time into 910 pixel locations. This is the same pixel rate used throughout the S-Series video system. 756 samples may be taken during the unblanked line time.

In lower resolution modes, the sampling delay may be moved in multiples of this basic sampling spacing.

The samplng delay position may be arbitrarily changed at will with an output port and does not have to follow a fixed pattern.

SAMPLE RATE

With the SDD, 1, 3, 6 or 12 samples may be taken per horizontal image line.

Gray scale, high resolution, and color image generation typically can use three samples per line, while waveform display can use 12 samples per line.

IMAGE GENERATION SPEED

Samples per Line	Image Size	Seconds to Digitize*
3	378 × 242	4
3	754 × 484	8
12	754 × 256	1

*Mapped mode.

DEMODULATION CAPABILITIES

The SDD provides real-time demodulation of NTSC composite video into separated RGB. Built-in keying circuitry simplifies the process of mixing the SDD output with other RGB signals, eg., S-Series video systems. This feature allows computer graphics to be overlayed with real-time video.

ADDITIONAL FEATURES

The SDD has an advanced design IC color demodulator, providing excellent performance and permitting software control of color amplitude and tint.

The input signal gain is controlled by a digital port with both manual and automatic level control modes available. Reference white level can be varied in both modes. Automatic video level control operates on the incoming sync pulse amplitude and is essentially unaffected by incoming image content variation.

All circuits incorporate DC restoration of the black level.

The digitizer produces an 8-bit data word for each pixel sample, which is delivered through the inverse map in all modes. In color conversion modes, the inverse map accepts 4 bits for each of the three primary colors and provides the 8-bit word to send to the CPU for each of the 4096 possible combinations. In single channel conversion modes where a single-color component is used (red, green or blue), the inverse color map receives an 8-bit word from the A/D circuitry. The inverse map then converts to an 8-bit output word. Only 8 of the 12 inverse map input bits are used in this mode. A total of 16 different arbitrary mapping functions can be held in the mapping RAM, adding versatility in image processing applications.

TECHNICAL SPECIFICATIONS Model SDD

Input Impedance:
75 ohms

Input Signal:
RS-170A composite NTSC or PAL color video or
RS-330 black and white video

Processor Output Control Ports:
Input Gain Level
Chroma
Tint
Inverse Map Data
Digitizer Operating Mode and Source Control
Strobes/Line and Delay Setting

Processor Input Control Ports:
Status Data: Horizontal Timing Flag
Vertical Blanking Flag
Vertical Sync Pulse
Vertical Timing Coarse Count
Digitizer Data (8-bit)

Bus:
IEEE-696 (S-100)

Power Requirements:
+ 18 volts at 0.25A
+ 8 volts at 1.0A
– 18 volts at 0.20A

Operating Environment:
0 to 55 degrees Centrigrade

PRODUCT GUIDE

Model	Description
SDCM-NTSC	Color Modulator Board, NTSC Standard
SDCM-PAL	Color Modulator Board, PAL Standard
SDD-NTSC	Color Digitizer Interface, NTSC Standard
SDD-PAL	Color Digitizer Inerface, PAL Standard
SDMA	Video Memory Controller Board
SVID-NTSC	Color Video Generator Board, NTSC Standard
SVID-PAL	Color Video Generator Board, PAL Standard
256KTP	Two-Port Memory Board

Cromemco

Cromemco, Inc.
280 Bernardo Ave.
P.O. Box 7400
Mountain View, CA 94039
(415) 964-7400
TWX 910-379 6988

023-8283